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A MODERN THEORY OF CELLS AND NONCELLULAR FORMS OF LIFE

[A Digest]

Idealistic tendencies associated with Virchow's teaching in the fields of cytology and histology for a long time prevented the study of problems which are of the greatest importance for the development of medicine and biology. Professor O. B. Lepeshinskaya, director of the Cytological Laboratory of the Institute of Experimental Biology, Academy of Sciences USSR, has shown in investigations extending over many years that Virchow's assumption to the effect that a cell can originate only from another cell is false. Lepeshinskaya demonstrated by the example of cell formation from egg-yolk globules that cells may form from substances which are devoid of cellular structure. She confirmed this in other instances, in the course of experiments with fish roe, cells of hydras, and other materials, showing that cells can also form from the structureless egg white of chicken eggs and other bird eggs.

Lepeshinskaya's book published in 1945 under the title, "Origin of Cells from Living Matter and the Role of Living Matter in the Organism," was received with acclaim by representatives of the Michurin school of biology. Lepeshinskaya's research is of fundamental importance in the sense that it opens up new ways for studying pre-cell forms of life, a problem hitherto investigated almost exclusively by her.

At the end of May 1950 a meeting, in which representatives of the Academy of Medical Sciences USSR and of the Agricultural Academy imeni V. I. Lenin participated, took place under the auspices of the Biological Division of the Academy of Sciences USSR. At this meeting reports by Professor Lepeshinskaya and her collaborators, O. P. Lepeshinskaya, V. G. Kryukov, and V. I. Sorokin, were presented. These reports were well received by the foremost specialists representing all branches of medical biology and other fields of biology who attended the meeting. Thus, Academician T. D. Lysenko pointed out the significance of the relationships discovered by Lepeshinskaya as permitting a better understanding of new formations occurring in animals and plants both in the course of phylogenesis and ontogenesis. Academician A. I. Oparin stated that the work on noncellular forms of life is of great significance and has resulted in a serious defeat to the concepts of the Virchow school. Laudatory appraisals also were made by Professor I. E. Glushchenko, and Academicians N. N. Anichkov, Ye. N. Pavlovskiy, and A. D. Speranskiy.

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Professor I. V. Davidovskiy, Vice-President of the Academy of Medical Sciences USSR, submitted to sharp criticism the pro-Virchow attitude of certain Soviet histologists, particularly of N. G. Khlopin, Acting Member of the Academy of Medical Sciences USSR, and drew a distinction between that attitude and the facts and ideas presented by Lepeshinskaya and her collaborators. The well-known histologist Professor G. K. Khrushchov emphasized the reliability of Lepeshinskaya's data and commented on the harmful effect which Virchow's ideas exert on the development of cytology and histology by preventing a study of the qualitative changes of tissues. The histologists Professors Baron, Lavrov, and Studitskiy, and other morphologists commented in the same vein and outlined concrete possibilities of the application of Lepeshinskaya's conclusions in the fields of cytology, histology, embryology, and oncology.

At present, the dogma that cells are produced only by cells is not only entrenched in the branches of morphology, but has penetrated even into biochemistry. For that reason the metabolism of the developing noncellular living substance has not yet really been studied. S. E. Severin, Acting Member of the Academy of Medical Sciences USSR, in bringing this out, mentioned the formation of new amino acids in the noncellular plasma of blood.

Professor A. A. Imshenitskiy, Doctor of Biological Sciences G. M. Bosh'yan, and other participants at the meeting emphasized the tremendous significance of Lepeshinskaya's theory in connection with contemporary views on the existence of noncellular modifications of microbes. The biologists emphasized the bearing which that theory has on problems in connection with vegetative hybridization, formation of sex cells, and generation of species. The pathologists discussed the general aspects of the theory as far as pathology is concerned, and its significance for the study of the cancer problem in general. The meeting unanimously reached the decision that the field of biological science in which Lepeshinskaya is a pioneer must be developed further.

According to Virchow's theory, everything in nature starts from a ready-made cell. A cell divides and forms an organism. As a result of constant division the sex cell is formed, the latter generating a new organism. This leads to Weisman's postulate of the continuity of the chromosome. It is understandable that Lepeshinskaya's finding to the effect that chromosomes are newly formed in cell ontogenesis represents a crushing blow to the Virchow-Weisman dogmas.

In the light of Lepeshinskaya's work, many disconnected facts which had been discovered previously become clear. It is sufficient to refer to the work of D. I. Ivanovskiy, who discovered the existence of viruses; the investigations of V. V. Suknev, M. D. Utenkov, S. I. Sherishorina, V. A. Kresovnikova, et al, who studied the invisible noncellular forms of microbes and the possibility of their transformation into visible cellular forms; the work of K. S. Sukhov on the nature of certain viruses; and finally, the conclusions of G. M. Bosh'yan summarized by him in the recently published book, "On the Nature of Viruses and Microbes." It has been definitely proven that bacteria may develop from noncellular forms. All this confirms Lepeshinskaya's theory and results.

Unless it is assumed that cells form from noncellular substances, i.e., that the living forms from the nonliving, it is impossible to understand development processes which take place in nature. Scientists who study the development of the plant organism have already reached that conclusion. Thus, A. A. Avakyan recently demonstrated the possibility of the generation in plants of reproducing vegetative cells which are biologically equivalent to sex cells. This phenomenon, as shown by the investigator, is based on metabolism.

Now that Lepeshinskaya's theory is completely victorious, it will not be out of place to mention the critics of this theory and to consider the reasons for their opposition. Some joined the camp of Virchow's and Weisman's adherents owing to an incomplete understanding of Michurin's teaching and a consequent inability to apply his theories to their work. It is not an accident that the well-known Morganist /adherent of the American genetecist T. H. Morgan/, Kol'tsov, opposed Lepeshinskaya as early as 1934. Less easy to understand is the critical attitude exhibited by more progressive scientists like Professor B. Tokin. In 1948 a group of biologists headed by D. N. Nasonov, Corresponding Member of the Academy of Sciences USSR, and N. G. Khlopin, Acting Member of the Academy of Medical Sciences USSR, expressed themselves against the tendencies developed by Lepeshinskaya. The reason for their opposition was undue adherence to Virchow's teaching which regards life as an uninterrupted chain of cells.

Lepeshinskaya's work permits a breach with the reactionary Virchow theory which delayed progress in biological research for so long. Cytologists, histologists, and embryologists are now acquiring the means of consciously interfering with the processes of tissue and organ formation. In biological chemistry it becomes possible to study the metabolism of noncellular living matter and to approach the synthesis of living matter at some future date. -- Candidate of Biological Sciences L. Kalinchenko, Candidate of Medical Sciences I. Mayskiy, Acting Members of the Academy of Medical Sciences USSR S. Sarkisov and N. Zhukov-Verezhnikov, and Corresponding Members of the Academy of Medical Sciences USSR V. Timakov and A. Strukov

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